Estuarine Bathymetric Digital Elevation Models (30 meter and 3 arc second resolution) Derived From Source Hydrographic Survey Soundings Collected by NOAA

Metadata also available as

Metadata:

- Identification_Information
- Data_Quality_Information
- Spatial_Data_Organization_Information
- Entity_and_Attribute_Information
- Distribution_Information
- Metadata_Reference_Information

Identification_Information:
Citation:
Citation_Information:
Originator:
Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), Special Projects (SP)
Publication_Date: 19980606
Title:
Estuarine Bathymetric Digital Elevation Models (30 meter and 3 arc second resolution) Derived From Source Hydrographic Survey Soundings Collected by NOAA
Geospatial_Data_Presentation_Form: raster digital data
Publication_Information:
Publication_Place: Silver Spring, MD
Publisher: NOAA's Ocean Service, Special Projects
Online_Linkage: <http://spo.nos.noaa.gov/bathy/finddata.htm>
Description:
Abstract:

These Bathymetric Digital Elevation Models (DEM) were generated from original point soundings collected during hydrographic surveys conducted by the National Ocean Service and its predecessors. Mean High Water shoreline was used as a constraining boundary and assigned its local elevation relative to the local datum (typically Mean Low Water). DEM grid values outside the shoreline (on land) were assigned null values (-32676). In the event of multiple surveys in a region,the most recent survey soundings were retained. Both 7.5 minute and 1 degree DEMs are available. The 1 degree DEMs were generated from the higher resolution 7.5 minute DEMs which covered the estuary. These DEMs are available as either Untiled (large grids) or sets of Tiled DEMs (at 7.5 degree minute size).

A Digital Elevation Model (DEM) contains a series of elevations ordered from south to north with the order of the columns from west to east. The DEM is formatted as one ASCII header record (A- record), followed by a series of profile records (B-records) each of which include a short B-record header followed by a series of ASCII integer elevations (typically in units of 1 centimeter {0.01 meter]) per each profile. The last physical record of the DEM is an accuracy record (C-record).

The 1 degree (60-minute) DEMs (3 arc second x 3 arc second data spacing) is cast on the geographic coordinate system (no projection). It provides coverage in 1 degree square blocks. Each product contains over edge data. Coverage is available for the many estuaries of the conterminous United States, but is not complete.

The 7.5-minute DEM (30- by 30-m data spacing) is cast on the Universal Transverse Mercator (UTM) projection. It provides coverage in 7.5- by 7.5-minute blocks. Each product provides the same coverage as a standard USGS 7.5-minute quadrangle but the DEM contains over edge data. Coverage is available for many estuaries of the contiguous United States but is not complete.

Purpose:

Bathymetric DEM's can be used as layers in Geographic Information Systems (GIS) for earth science analysis. DEM's can also serve as tools for volumetric analysis, for site location of structures, or for drainage basin delineation. The source soundings are collected by the NOS Office of Coast Survey (OCS).

Supplemental_Information:

The datum for these bathymetric DEMs (Mean Low Water) is not the same as that used by the United States Geological Survey (USGS) for land based DEMs (NAV29) which results in a discontinuity of about 1/2 the tidal range. Moreover, the shoreline for the USGS DEMs is indeterminate and not the same as that used for the Bathymetric DEMs. Furthermore, the vertical resolution is smaller and accuracy of the Bathymetric DEMs is better than USGS DEMs. Because of these differences, extreme care should be used in merging NOAA and USGS DEM data.

One degree bathymetric DEMs have profiles (north-south lines) containing 1201 soundings. Missing values (over land as defined by the Mean High Water Line) are filled with null values represented by the value -32676. Profiles within the 1 degree square which contain only null values are omitted.

7.5-minute DEMs have rows and columns which vary in length and are staggered. The UTM bounding coordinates form a quadrilateral (no two sides are parallel to each other), rather than a rectangle. The user will need to pad out the uneven rows and columns with blanks or flagged data values, if a rectangle is required for the user's application. Some software vendors have incorporated this function into their software for input of standard formatted USGS DEMs.

Time_Period_of_Content:

Time_Period_Information:

Range_of_Dates/Times:

Beginning_Date: 1839

Ending_Date: 1989

Currentness_Reference: ground condition

Status:

Progress: Complete
Maintenance_and_Update_Frequency: Irregular
Spatial_Domain:
Bounding_Coordinates:
West_Bounding_Coordinate: -125.00
East_Bounding_Coordinate: -65.00
North_Bounding_Coordinate: 50.00
South_Bounding_Coordinate: 24.00
Keywords:
Theme:
Theme_Keyword_Thesaurus: none
Theme_Keyword: DEM
Theme_Keyword: digital elevation model
Theme_Keyword: digital bathymetric model
Theme_Keyword: digital terrain model
Theme_Keyword: bathymetry
Theme_Keyword: altitude
Theme_Keyword: height
Theme_Keyword: depth
Theme_Keyword: elevation
Theme_Keyword: ocean
Place:
Place_Keyword_Thesaurus: None
Place_Keyword: U.S. Exclusive Economic Zone
Access_Constraints: none
Use_Constraints:
Not to be used for Navigation.

Acknowledgment of the National Oceanic and Atmospheric Administration- Nation Ocean Service would be appreciated in products derived from these data.

The datum for these bathymetric DEMs (Mean Low Water) is not the same as that used by the US Geological survey (USGS) for land based DEMs (NAV29) which results in a discontinuity of about 1/2 the tidal range. Moreover, the shoreline for the USGS DEMs is indeterminate and not the same as that used for the Bathymetric DEMs. Furthermore, the vertical resolution is smaller and accuracy of the Bathymetric DEMs is better than USGS DEMs. Because of these differences, extreme care should be used in merging NOAA and USGS DEM data.

Point_of_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: NOAA, NOS, Special Projects
Contact_Position: Chief, National Communications Branch
Contact_Address:
Address_Type: mailing and physical address
Address: 1305 East West Hwy. N/MB6
City: Silver Spring
State_or_Province: MD
Postal_Code: 20910-3281
Country: U.S.

Contact_Voice_Telephone: 301-713-3000
Contact_Facsimile_Telephone: 301-713-4384
Contact_Electronic_Mail_Address: mapfinder@noaa.gov

Native_Data_Set_Environment:
Microsoft Windows 2000 Version 5.0 (Build 2195) Service Pack 2; ESRI ArcCatalog 8.2.0.700

Data_Quality_Information:

Attribute_Accuracy:

Attribute_Accuracy_Report:
The accuracy of a DEM is dependent upon the level of detail of the source soundings and the grid spacing used to sample that source. The primary limiting factor for the level of detail of the source is the scale of the source survey, the technology used to collect soundings, and the resolution of the source soundings. Additional complications in describing accuracy are the ages of the surveys used to collect sounding in a given area. Care was used to use the most recent surveys covering a given area but in some instances adjacent surveys may be decades apart in age. In some regions, the only source data were at fathom (6 feet) resolution. In general, most source surveys were certified to one foot or better by the National Ocean Service.

Logical_Consistency_Report:
The fidelity of the relationships encoded in the data structure of the DEM are automatically verified using a NOAA-NOS software program upon completion of the data production cycle. The test verifies full compliance to the DEM specification.

Completeness_Report:
The DEM is visually inspected for completeness on a DEM view and edit system for the purpose of performing a final quality control and if necessary, edit of the DEM. The physical format of each DEM is validated for content completeness and logical consistency during production quality control.

Due to the variable orientation of the 7.5 minute quadrilateral in relation to the Universal Transverse Mercator (UTM) projection grid, profiles that pass within the bounds of the DEM quadrilateral may be void of elevation grid points and are not represented in the DEM. This condition occurs infrequently and is always the first or last profile of the dataset.

DEM's may contain void areas caused by elevations being above Mean High Water or on non-tidal land. Void elevations are assigned the value of -32,767. In addition, suspect elevation areas may exist in the DEM but are not specifically identified.

Positional_Accuracy:

Horizontal_Positional_Accuracy:

Horizontal_Positional_Accuracy_Report:
The horizontal accuracy of the DEM is expressed as an estimated root mean square error (RMSE). The estimate of the RMSE is based upon horizontal accuracy tests of the source soundings used to generate the DEM. As a first approximation the locational accuracy of the source soundings are 0.0015 m at source "Smooth Sheet" scale (120 m @ 1:80,000 to 15 m @ 1:10,000). Smooth Sheets are maps generated as a principle product of each (historic) hydrographic survey with fully corrected soundings plotted on them.

Quantitative_Horizontal_Positional_Accuracy_Assessment:

Horizontal_Positional_Accuracy_Value: 3 meters [estimated]
Horizontal_Positional_Accuracy_Explanation:
Digital elevation models comply with the National Map Accuracy Standards (NMAS) accuracy requirements.
Vertical_Positional_Accuracy:
Vertical_Positional_Accuracy_Report:
The vertical RMSE statistic is used to describe the vertical accuracy of a DEM. It encompasses both random and systematic errors introduced during production of the data. The RMSE is encoded in element number 5 of record C of the DEM. This accuracy estimate includes components related to quantization of the source soundings (1.3 to 0.15 m), the systematic editing of the source data (1% or 0.10m), un-sampled bathymetric features (estimated at less than 5% of depth), time related changes (erosion, deposition, and seismic shifts), and dredging operations (cut and fill).

It is estimated that the accuracy of the Bathymetric DEMs is 2% of depth or 1 meter for depths grater than 20 meters and 2 % of depth or 0.20 meters for depths shallower than 20 meters. THESE DEMs SHOULD NOT BE USED FOR NAVIGATION.

There are three types of DEM vertical errors: blunder, systematic, and random. These errors are reduced in magnitude by editing but cannot be completely eliminated. Blunders are errors of major proportions and are easily identified and removed during interactive editing. Systematic errors follow some fixed pattern and are introduced by data collection procedures and systems. Systematic error artifacts include vertical unsampled elevation shifts, relative spacing of the source soundings, misinterpretation of terrain surface caused by softness or poor reflectivity and by the resolution of the collected soundings (feet, feet & fractions, fathoms, fathoms & fractions, meters, tenths of meters etc.). Random errors result from unknown or accidental causes. The 1 degree (DSQ) DEMs are generated from 30 m grids on UTM projection. The RMSE difference between these surfaces is an estimate of the vertical accuracy of the DSQ DEMs.

Lineage:
Source_Information:
Source_Citation:
Citation_Information:
Originator:
National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), Special Projects
Publication_Date: 1997
Title: National Ocean Service- Hydrographic Survey Data
Geospatial_Data_Presentation_Form: map
Publication_Information:
Publication_Place: Boulder, CO
Publisher:
NOAA, National Environmental Satellite, Data and Information Service (NESDIS), National Geophysical Data Center (NGDC)
Online_Linkage:

<http://www.ngdc.noaa.gov:80/mgg/geodas/hyddas.html>
Type_of_Source_Media: CD-ROM
Source_Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 1839
Ending_Date: 1991
Source_Currentness_Reference: date of surveys
Source_Citation_Abbreviation: GEODAS vol 2 ver 3.3
Source_Contribution: Hydrographic Soundings
Source_Information:
Source_Citation:
Citation_Information:
Originator:
National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS)
Publication_Date: 1994
Title: Medium Resolution Vector Shoreline
Geospatial_Data_Presentation_Form: vector digital data
Publication_Information:
Publication_Place: Boulder, CO
Publisher: NOAA's Ocean Service
Type_of_Source_Media: CD-ROM
Source_Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 1970
Ending_Date: 1990
Source_Currentness_Reference: publication date
Source_Citation_Abbreviation: NOAA
Source_Contribution: Shoreline position
Source_Information:
Source_Citation:
Citation_Information:
Originator:
United States Geologic Survey (USGS) or NOAA's National Geodetic Survey (NGS)
Publication_Date: 19920503
Title: Project control
Publication_Information:
Publication_Place: Reston, VA
Publisher: U.S. Geological Survey
Type_of_Source_Media: magnetic tape
Source_Time_Period_of_Content:
Time_Period_Information:
Single_Date/Time:
Calendar_Date: 19920503
Source_Currentness_Reference: ground condition
Source_Citation_Abbreviation: CONTROL1
Source_Contribution: Ground control points
Process_Step:

Process_Description:

The production procedures, instrumentation, hardware, and software used in the collection of standard National Oceanic and Atmospheric Administration (NOAA) Bathymetric Digital Elevation Models (DEM's) vary depending on systems used at the time of the survey.

Logsheets were kept at all stages of processing to track file names, dates, hydrographic survey coverage, and soundings or hydrographic surveys that were deleted as part of the quality control process. A short summary of the processing steps for each estuary is available on the individual data pages. In addition, a list of each of the surveys which were included is accessible through the individual data pages.

Original hydrographic data from the National Ocean Service and it predecessors was used exclusively as source data. Processing was performed on desktop computers using a variety of commercial and custom software systems. The two main software systems used were Digital Optimization of Grid Systems (DOGS) version 1.5x software developed by NOAA and MapInfo Professional version 4.5 published by MapInfo augmented by a MapInfo add-on named Vertical Mapper published by Northwood Geosciences. The processing sequence for each estuary started with the generation of a comprehensive source data set from the NOS archives. These source sounding were quality controlled to eliminate outliers and superseded surveys, optimized to reduce the number of data values, augmented with points representing the Mean High Water shoreline, and then gridded. The gridded data sets were converted from the internal proprietary grid format to Digital Elevation Model (DEM) format for public distribution.

Creating Point Sets of Hydrographic Survey Data: Sounding data obtained from Hydrographic Surveys were extracted using DOGS from the GEODAS CD distributed by the National Geophysical Data Center using each estuary's shoreline as a clipping boundary. Large estuaries were broken into several overlapping regions and subsets of points were extracted and processed. Most historic hydrographic surveys are included on the GEODAS CD. For those regions which were missing data (parts of southern Florida & Chesapeake Bays only), soundings were digitized from a hard copy Smooth sheets generated by the Hydrographic Surveys.

Editing and Quality Control of Bathymetry Point Data: The first step of the quality control was to review the data using the DOGS software. The data were first examined for surveys or parts of surveys that are redundant. For many areas there are more surveys than are actually useful. Entire surveys or large portions of surveys were deleted for the following reasons: - Another more recent survey fully covers the same area. - The survey has questionable values which can not be fixed by way of figuring out a mathematical update value for the entire survey, and there are too many bad points to pick out probable "good" values. - Sections of surveys were omitted if they were overlapped by more accurate surveys or by similar yet denser coverage. The second step was to display the data by depth values and to remove stray points that were obvious outliers from the surrounding data values.

Optimizing the Bathymetry Point Data using DOGS: The data was first triangulated in DOGS in order to optimize the set of points. The computer program DOGS can analyze a large set of bathymetric data and create from it a smaller set of optimized points which describes the bathymetry of a geographic region to within a user defined error. This smaller data set then can be used on its own as a representation of the area's bathymetry, or as input into other computer programs or Geographical Information Systems.

There are two calculation options for triangulation in DOGS: relative and absolute. Bathymetry point files were cut into sections for separate processing based on mean depth of 10 meters. A relative height error criteria of 0.01 was used for the triangulation of regions whose depths averaged above 10 meters. An absolute height error criteria of 0.1 meters was used for areas with average depths less than 10 meters. The two resultant files were saved as text files. After combining these files, the vertical error associated with the optimized data set was 1% of depth or 0.1 meters, whichever was greater. The optimized DOG file was imported into MapInfo's MapInfo Professional desktop mapping software.

Augmenting the data set with Shoreline Points: The final bathymetry was clipped to NOAA's 1:250,000 Coastal Assessment Framework (CAF) shoreline. A copy of the shoreline file was edited to create a point file from the vector vertices and optimized using DOGS to produce a more workable, smaller file, with little compromise to the shape of the shoreline. Mean High Water tide level was assigned to the shoreline points to give them a height. These Shoreline data points were added to the set of bathymetry points before doing the final triangulation in MapInfo.

Generation of a Gridded Bathymetry Dataset: Linear triangulation of the combined point files were done in MapInfo using the Vertical Mapper 2.0 partner product software. The resultant TIN file was then used to create a continuous grid file with 30 meter resolution on a UTM projection using a NAD27 horizontal datum. A second grid was created from the first by aggregating the 30 meter grid values to 90 meter resolution and exporting the 90m center points. A new TIN was created after reattaching the shoreline points. The triangle side lengths and coincident point distances were small enough to disallow interpolation outside the 90m distance, so as to emulate a rectangular interpolation and still allow the shoreline to be represented without averaging out the values. The result of the new file is a geographic 3 arc second resolution grid. Both grids were cut to the estuary boundary shoreline. 7.5 minute and 1 degree sections were then created from these grids. The 7.5 minute grids have 30 meter resolution in a UTM projection using the NAD27 datum. The 1 degree grids have a 3 arc second resolution in a geographic projection (Latitude/Longitude) using the NAD27 datum.

Creating DEM files: The MapInfo grid files were converted to a public domain USGS format DEM files using the NOAA DEM maker software. Both Untiled (large grid) DEMs and Tiled (7.5 degree minute cells) DEMs were generated. The formats available for downloading are 30 meter & 3 arc second DEMs in USGS DEM format.

DEM's are viewed on interactive editing systems to identify and correct blunder and systematic errors. DEM's are verified for physical format and logical consistency.

Process_Date: Unknown

Process_Step:

Process_Description: Metadata imported.

Source_Used_Citation_Abbreviation: C:\DOCUME~1\RACHEL~1.ISA\LOCALS~1\Temp\xml14.tmp

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Spatial_Data_Organization_Information:

Direct_Spatial_Reference_Method: Raster

Raster_Object_Information:

Raster_Object_Type: grid cell

Entity_and_Attribute_Information:

Overview_Description:

Entity_and_Attribute_Overview:

The digital elevation model is composed of a elevation value linked to a grid cell location representing a gridded form of a bathymetric map overlay. Each grid cell entity contains a 6-character integer value between -32,767 and 32,768. The grid is generated from profiles of data each containing header information (profile identifier, starting point, relative datum for profile values (deepest value within the DEM), number of values, etc) followed by profile values relative to the relative datum for the profile. All non-null values in the profile are positive.

Entity_and_Attribute_Detail_Citation:

U.S. Department of the Interior, U.S. Geological Survey, 1992, Standards for digital elevation models: Reston, VA, A hypertext version is available at: <http://www-nmd.usgs.gov/www/ti/DEM/standards_dem.html> Softcopy in ASCII format is available at: <ftp://www-nmd.usgs.gov/www/ti/DEM/stdempt1.txt> <ftp://www-nmd.usgs.gov/www/ti/DEM/stdempt2.txt> <ftp://www-nmd.usgs.gov/www/ti/DEM/stdempt3.txt> Softcopy in WordPerfect format is available at: <ftp://www-nmd.usgs.gov/www/ti/DEM/stdempt1.wp5> <ftp://www-nmd.usgs.gov/www/ti/DEM/stdempt2.wp5> <ftp://www-nmd.usgs.gov/www/ti/DEM/stdempt3.wp5> Softcopy in PostScript format is available at: <ftp://www-nmd.usgs.gov/www/ti/DEM/stdempt1.ps> <ftp://www-nmd.usgs.gov/www/ti/DEM/stdempt2.ps> <ftp://www-nmd.usgs.gov/www/ti/DEM/stdempt3.ps>

Distribution_Information:

Distributor:

Contact_Information:

Contact_Organization_Primary:

Contact_Organization: NOAA, NOS Special Projects

Contact_Position: Chief, National Communications Branch

Contact_Address:
Address_Type: mailing and physical address
Address: 1305 East West Hwy. N/MB^
City: Silver Spring
State_or_Province: Maryland
Postal_Code: 20910
Country: U.S.
Contact_Voice_Telephone: 301-713-3000
Contact_Facsimile_Telephone: 301-713-4384
Contact_Electronic_Mail_Address: mapfinder@noaa.gov
Hours_of_Service: 0800-1600 Monday -Friday, EST
Resource_Description: Downloadable Data
Distribution_Liability:
Although these data have been processed successfully on a computer system at the National Oceanic and Atmospheric Administration, no warranty expressed or implied is made by NOAA regarding the utility of the data on any other system, nor shall the act of distribution constitute any such warranty. The National Oceanic and Atmospheric Administration will warrant the delivery of this product in computer-readable format and will offer appropriate adjustment of credit when the product is determined unreadable by correctly adjusted computer input peripherals, or when the physical medium is delivered in damaged condition. Requests for adjustment of credit must be made within 90 days from the date of this shipment from the ordering site.
Standard_Order_Process:
Digital_Form:
Digital_Transfer_Information:
Format_Name: DEM
Format_Information_Content:
USGS standard DEM: The standard USGS DEM can be described as an ASCII formatted elevation file preceded by a metadata header file of one 1024 byte ASCII record.
Transfer_Size: 1
Digital_Transfer_Option:
Online_Option:
Computer_Contact_Information:
Network_Address:
Network_Resource_Name: <http://mapfinder.nos.noaa.gov>
Network_Resource_Name:
<http://www-orca.nos.noaa.gov/projects/bathymetry/bathymetry.htm
Offline_Option:
Offline_Media: CD-Recordable
Recording_Capacity:
Recording_Density: 650
Recording_Density_Units: megabytes
Recording_Format:
ISO 9660; the files are placed in a flat directory on the CD with naming conventions that are ISO 9660 Level 1 compliant (DOS 8.3).
Fees:
The online copy of the data set is available at no cost. The cost of data sets on CD-ROM has not been determined and until priced, will not be available.

Metadata_Reference_Information:
Metadata_Date: 20030123
Metadata_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: NOAA, NOS Special Projects
Contact_Position: Chief, National Communications Branch
Contact_Address:
Address_Type: mailing and physical address
Address: 1305 East West Hwy. N/MB6
City: Silver Spring
State_or_Province: Maryland
Postal_Code: 20910
Country: U.S.
Contact_Voice_Telephone: 301-713-3000
Contact_Facsimile_Telephone: 301-713-4384
Contact_Electronic_Mail_Address: mapfinder@noaa.gov
Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata
Metadata_Standard_Version: FGDC-STD-001-1998
Metadata_Time_Convention: local time
Metadata_Extensions:
Online_Linkage: <http://www.esri.com/metadata/esriprof80.html>
Profile_Name: ESRI Metadata Profile
